PROGRESS OF THE TIDE ROUND GREAT BRITAIN.

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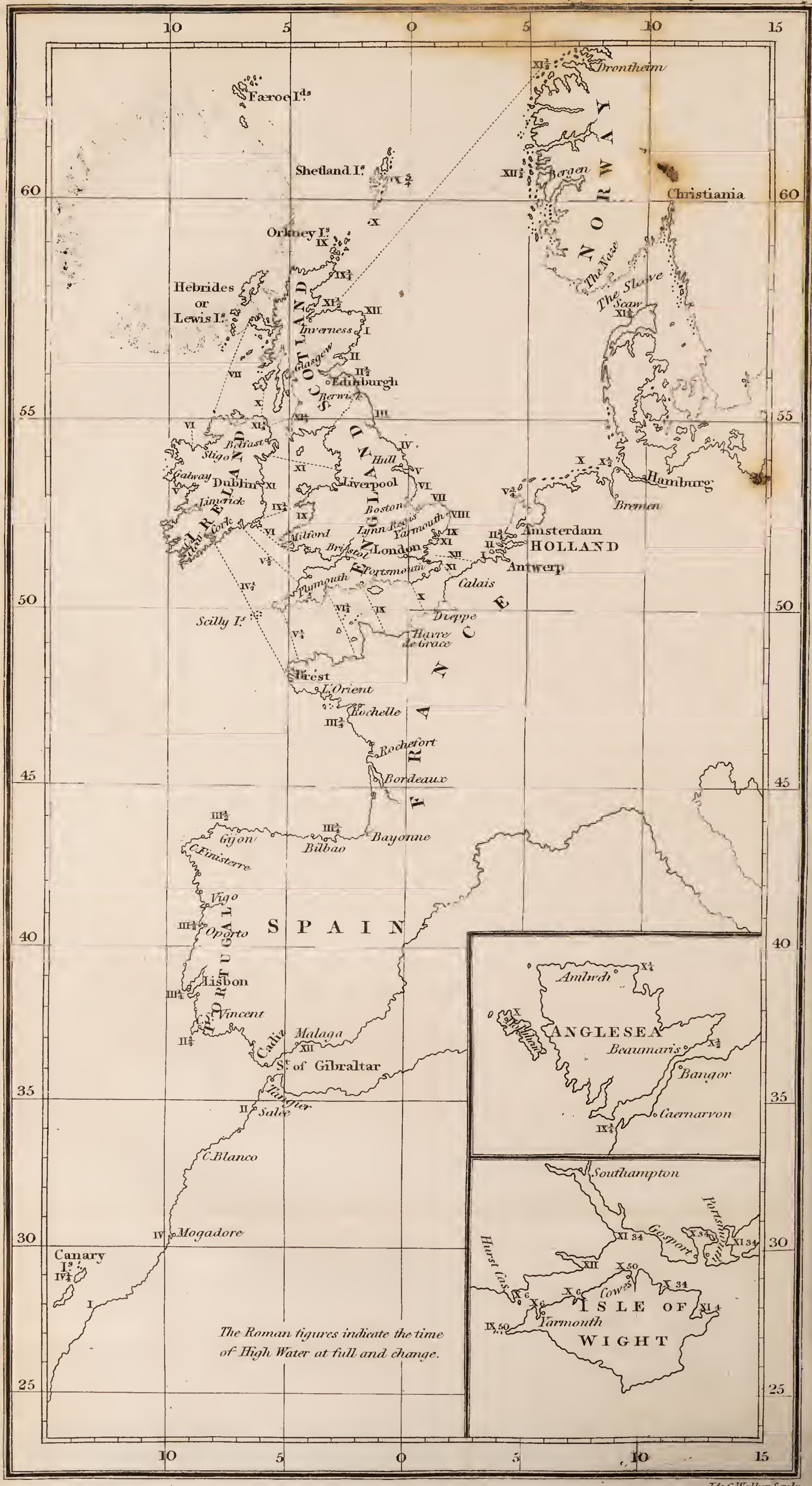

The Roman figures indicate the time of High Water at full and change.

J. & C. Walker Sculp.

LII. *On the Tides on the Coast of Great Britain.* *By* J. W. Lubbock, *Esq. F.R.S.*[*]

[With a Map.]

MUCH valuable information on the subject of the tides being scattered in works relating to navigation, it may perhaps be useful to exhibit at one view in a small map the progress of the tide or high water round Great Britain, where it is better known than in any other part of the globe, the rise throughout being considerable, and therefore the time of high water easily observed. The plan of the map is taken from one in the first volume of Dr. Young's Lectures on Natural Philosophy. I hope it may tend to draw the attention of scientific men residing on the coast to this important subject, which has been hitherto so much neglected. It is to be regretted that the time of high water is not given in all maps in those few places where it is known with sufficient accuracy.

The progress of the tide round Great Britain is a striking instance how much this phænomenon is influenced by local circumstances: for while the tide in the open ocean follows the moon, proceeding from East to West; here the general direction, and particularly that of the tide up the Channel, is from West to East. The tide which arrives from the Atlantic divides into two branches; the one going up St. George's Channel, the other up the English Channel. The former meets the tide from the north-west coast of Ireland near St. John's Point on the north-east coast of Ireland, opposite the Isle of Man. The other branch proceeds up the Channel, making high water at Beachy Head, Dungeness, and Deal, at nearly the same time as at Dieppe, Boulogne and Calais. This tide appears to divide, after passing the Straits of Dover, into two branches; one of which meets the tide which comes from the North, at the sand called the Kentish Knock; the other branch makes flood tide along the opposite coasts of Flanders, Holland and Jutland, as far as the entrance of the Sleeve. The tide from the north-west coast of Ireland divides into two branches; one of which meets the tide which comes up St. George's Channel near St. John's Point, as before said; the other proceeds round the coast of Great Britain until it meets the tide which comes up the English Channel, off the Kentish Knock.

There is no perceptible tide on the opposite coast of Norway, although there is further north, as at Hammerfest and at the North Cape. The *crest* of the tide which makes high water at the south-western extremity of Ireland at about 5 o'clock on full and change, arrives at Calais about six hours afterwards, nearly at the same time that another branch, which proceeds round the western coasts of Ireland and Scotland, makes high water at the Orkney Islands, as may be seen in the map.

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[*] Communicated by the Author.

It is usual to give the time of high water *at full and change*, which is called *the establishment* of the port. This is marked in Roman figures in the accompanying map.

The time of high water at full and change is affected by the moon's parallax and declination: if therefore the time be observed at this point of the moon's age, the correction for parallax and declination should be applied with a contrary sign, in order to reduce it to some fixed standard. It would be better to give the time of high water when the moon passes the meridian at 2 o'clock, the time being then, according to theory, not so sensibly affected by parallax. It is also usual to give the height of *spring tides* and *neap tides.* These vague terms may answer the purpose of a popular explanation; but when accuracy is required, the age of the moon corresponding to the given height should be defined by the time of her transit to the nearest minute, and her parallax and declination as well as the month of the year should be stated, which circumstances have a material influence. When but few observations are made, the direction of the wind should also be remarked.

In order to determine the establishment of any port, the time of high water may be observed at different syzygies, and the mean of these observed times compared with the mean of the moon's corresponding transits. Suppose, for example, the mean of different observed times of high water at any port is five hours, and the mean of the moon's corresponding transits $0^h\ 10^m$, the establishment of the port is $4^h\ 50^m$; neglecting the influence of parallax and declination.

Many details concerning the tides on the coast of Great Britain may be found in the following works:—Directions for navigating in the North Sea, by M. J. F. Dessiou. Directions for navigating throughout the English Channel, by the same Author. And, Sailing Directions for St. George's Channel, by Messrs. T. and A. Walker.

For the reasons stated above, the times of high water at full and change given in those works can only be considered as very rough approximations, until the methods by which they have been determined are explained in detail.

The lines in the map stretching from coast to coast, are intended to represent the *crest* of the water, or what may be called cotidal lines, being the series of points where it is high water

water at the same instant. It is difficult, however, to determine the form of these lines, which are generally, no doubt, perpendicular to the direction of the current, from the want of means to determine the time of high water at sea. The times in the map are intended to be *Greenwich time;* the extent, however, included by the map, and the scale, are so small, that the differences between the Greenwich time and the time at the place, in the present state of our information is of little consequence.

LIII. *On the Reduction of the North Polar Distances of Stars observed at Greenwich, and corrected by* Bradley's *Refractions, to Distances according with* Ivory's *Refractions. By* W. Galbraith, *Esq. A.M.*[*]

IN the construction of the following Table, it is supposed that the observations are made when the celestial objects are on the upper meridian; consequently, the zenith distances are North as far as 38°½ nearly, and South as far as 85°, where the Table of Bradley terminates in the first volume of Mr. Pond's Greenwich Observations, page v.[†]

The error of the refractions of Bradley at the pole is −0″·53; that is, 0″·53 must be subtracted from polar distances, as those of the Greenwich Catalogue by Bradley's refractions, to obtain those by Ivory's. The French refractions, as well as those of Brinkley and Bessel, differ but slightly from those of Ivory at moderate zenith distances; consequently the Table will also give the results from these tables very nearly.

As the corrections were computed when the barometer is supposed at 30 inches, and the thermometer at 50° Fahrenheit, there will be a slight difference if the barometer and thermometer deviate greatly from these, though in all ordinary cases the error from this cause will be very slight, since the correction is only a small relative quantity. Such a table as this is alluded to by Mr. Pond in page 237, but has not, so far as I am aware, been any where published. The difference, indeed, never much exceeds 1″½ till about 83° zenith distance, and at 85° it is not less than 6″½, though, no doubt, observations when great accuracy is required will not be made at such low altitudes.

From the peculiar mode of observing by the mural circle as used at Greenwich, some other consequences would be elicited;

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[*] Communicated by the Author.

[†] It may be remarked here, that the logarithms of the factor for the English barometer in page xi. to reduce the French table for pressure, are all slightly erroneous by supposing 0m·76 = 29in·94 instead of 29·922.